



Nationwide Health Information Network (NHIN)

Health Information Event Messaging (HIEM)

Web Service Interface Specification

V 2.0

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Document Approval

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1 Preface

1.1 Introduction

The Nationwide Health Information Network (NHIN) Web Service Interface specifications define the core set of standard services to be implemented by each node on the NHIN network in order exchange interoperable health information over the Internet. Health Information Organizations (HIOs) which act as nodes on the NHIN are termed NHIOs. These functional services provide discovery and information exchange capabilities and rest upon a foundational set of messaging, security, and privacy services.

This document presents the NHIN Health Information Event Messaging (HIEM) Web Service Specification. This specification defines the transactions which underlie the NHIN's "Pub/Sub" information exchange pattern. HIEM allows entities exchanging health information on the NHIN to establish subscriptions to health content.

It is important to note that this specification does not include the information needed to request or fulfill any specific type of subscription, nor its content. NHIOs utilizing HIEM for a given Pub/Sub transaction supported by the NHIN must refer to that HIEM Profile, which describes the use of HIEM for specific transactions and user cases.

1.2 Intended Audience

The primary audiences for NHIN Specifications are the individuals responsible for implementing software solutions that realize these interfaces at Health Information Organizations (HIOs) who are, or seek to be, nodes on the NHIN network. This specification document is intended to provide an understanding of the context in which the web service interface is meant to be used, the behavior of the interface, the Web Services Description Language (WSDLs) used to define the service, and any Extensible Markup Language (XML) schemas used to define the content.

1.3 Business Needs Supported by this Specification

In addition to "Query/Retrieve" and "Push", the NHIN must support a publish and subscribe information exchange pattern in order to enable a wide range of transaction types. HIEM defines a generic publish and subscribe mechanism that can be used to enable various use cases. Examples include:

- Public Health reporting
- Support for notification of the availability of new or updated data
- Support for secondary use of clinical data including data provisioning and distribution of data transmission parameters
- Support of consumer information location requests and data routing to consumer-identified personal health records

In order to enable any specific pub/sub transaction, NHIN nodes must utilize this generic HIEM specification, as well as the HIEM profile which describes the specific transaction. Implementers should think of HIEM as an information exchange pattern and an HIEM profile as an instance of use for that pattern.

1.4 Referenced Documents and Standards

The following documents and standards were referenced during the development of this specification. Deviations from or constraints upon these standards are identified below.

- 1) **Org/SDO name:** OASIS

Reference # / Spec Name: WS-BaseNotification

Version #: v 1.3



NHIN Deviations or Constraints:

- Only the Subscribe, Unsubscribe, and Notify messages and their responses are used. Retrieve messages have not been included in this version for lack of a specific use case. However, notify/retrieve transactions can likely be supported via an HIEM profile. For more information regarding this, see section 2.3 “Transaction Standard”.
- WS-BaseNotification also defines a “Renew” message to extend the life span of a subscription; however, this specification does not make use of time-limited subscriptions, so the “Renew” operation is not required.
- Constraints to the Notify message are detailed in section 3.1.4 of this specification.
- Constraints related to subscribe and notify messages are identified in sections 3.1.2 “Subscribe” and 3.1.4 “Notify”.

Underlying Specs:

Link:

http://docs.oasis-open.org/wsn/wsn-ws_base_notification-1.3-spec-os.pdf

2) **Org/SDO name:** OASIS

Reference # / Spec Name: WS-Topics

Version #: v 1.3

NHIN Deviations or Constraints:

Underlying Specs:

Link:

http://docs.oasis-open.org/wsn/wsn-ws_topics-1.3-spec-os.pdf

3) **Org/SDO name:** IHE

Reference # / Spec Name: IT Infrastructure Technical Framework Volume 2a

Version #: v 6.0 Final Text August 10, 2009

NHIN Deviations or Constraints:

Underlying Specs:

Link:

http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol2a_FT_2009-08-10-2.pdf

1.5 Relationship to Other NHIN Specifications

This specification is related to other NHIN specifications as described below:

- **Messaging Platform** – specifies a base set of messaging standards and web service protocols which must be implemented by each NHIN node and applies to all transactions. All NHIN inter-nodal messages are SOAP messages over HTTP using web services, must be encrypted and digitally signed.
- **Authorization Framework** – defines the exchange of metadata used to characterize each NHIN request. The purpose of that exchange is to provide the responder with the information needed



to make an authorization decision for the requested function. Each initiating message must convey information regarding end user attributes and authentication using SAML 2.0 assertions.

Together, the Messaging Platform and the Authorization Framework define the foundational messaging, security and privacy mechanisms for the NHIN.

- **Web Services Registry** – enables nodes to discover each other through interactions with the NHIN UDDI registry, which lists NHIN nodes, the NHIN web services supported by each node, and how to reach those service end points. In this context, it might be needed to identify target nodes.
- **HIEM Profile Specifications:** HIEM Profiles further extend or constrain the HIEM service in order to define specific uses of that service. These profiles include the information needed to request and fulfill a specific type of subscription. An example of this is the Geocoded Interoperable Population Summary Exchange (GIPSE) Profile, which defines how the HIEM service may be used to exchange CDC-defined GIPSE population health data. HIEM Profiles follow the template defined in the HIEM Profile Framework.

2 Interface Description

2.1 Definition

HIEM allows NHIOs to request to subscribe or unsubscribe to various classes of content and events, and to notify NHIOs when content or events matching a subscription have been created or modified. Any NHIO seeking to utilize the pub/sub exchange pattern must utilize the HIEM service and apply the relevant HIEM Profile.

HIEM Profiles will be established for each NHIN pub/sub transaction. Profiles define specific type of content or event that can be subscribed to, and the conditions under which notifications should occur.

WS-BaseNotification defines three* messages types relevant to HIEM:

1. Subscribe
2. Unsubscribe
3. Notify

* WS-BaseNotification also defines a “Renew” message to extend the life span of a subscription; however, this specification does not make use of time-limited subscriptions, so the “Renew” operation is not required.

WS-Topics defines topic-based subscription and notification messages. Topics are items of interest, including specific classes of content and events. For example, an NHIO may wish to subscribe to population health events such as disease outbreaks. NHIOs may also wish to subscribe to classes of content such as advanced directives or H1N1 laboratory messages. NHIOs that support certain topics may accept subscription requests for those topics, and if accepted, notify subscribers when content or events matching the topic criteria are published. If a given NHIO does not support a certain topic, then that NHIO will return a message stating that particular topic is unsupported.

2.2 Design Principles and Assumptions

The following assumptions or design principles underlie this specification:

- The particular types of data that can be exchanged through this pub/sub information exchange pattern are not defined by this specification, but are anticipated to be defined in HIEM Profiles that reference this specification.
- HIEM Profiles will adhere to the template and guidance provided in the HIEM Profile Framework



- This specification does not include the business rules or policies that define the conditions under which an NHIO would choose to subscribe to particular data, or notify another NHIO when data is available. Such rules or policies may be defined in HIEM Profiles that reference this specification, or they may be separately addressed by NHIO-specific business rules and/or NHIN Operating Procedures
- HIEM requests are subject to the responding NHIOs authorization decision, which may evaluate each request against local consumer preferences and local policies and permissions.

2.3 Triggers

An NHIO desires to subscribe or unsubscribe to a particular type of content or event available from another NHIO. HIEM is used to request a subscription, or cancel a previous subscription to the available content or event. HIEM is further used by an NHIO, which has previously granted a subscription, to exchange with a subscribing NHIO the information to which that NHIO has subscribed.

2.4 Transaction Standard

This specification identifies the WS-BaseNotification standard from OASIS as the base standard for HIEM messages. Only the following messages from WS-BaseNotification are required:

- Notify
- Subscribe
- SubscribeResponse
- Unsubscribe
- UnsubscribeResponse

WS-BaseNotification also defines a “Renew” message to extend the life span of a subscription; however, this specification does not make use of time-limited subscriptions, so the “Renew” operation is not required.

This specification further recognizes the WS-Topics standard from OASIS as the standard for identifying classes of content and events to which an NHIO may subscribe and of which an NHIO may notify. The WS-Topics standard contains four (4) dialects for expressing topics. The default dialect for HIEM transactions is the “Concrete” dialect. However, specific topic profiles may require other dialects. Profiles that require alternative dialects will define them.

2.5 Technical Pre-conditions

The following technical pre-conditions exist for this interface specification:

- The NHIO(s) to which a subscription request will be directed have been selected and applicable service end points have been identified.
- Subscription criteria have been met.

2.6 Technical Post-conditions

The following technical post-conditions will result after the execution of this interface specification:

- Errors encountered will be handled, as specified in Section 4 “Error Handling”.
- Audit records are created and stored by both the requesting and responding NHIO, as described in section 5 “Auditing”.
- Local policies and permissions were enforced by the responding NHIO.

3 Interface Definition



3.1 Message Syntax

The messages defined in this specification utilize elements defined in several different sources, as described in the following table. Readers and implementers are urged to pay careful attention to the XML namespaces used in this document.

Namespace prefix used in this document	Full namespace identifier	Description
wsnt	http://docs.oasis-open.org/wsn/b-2	WS-BaseNotification standard
wstop	http://docs.oasis-open.org/wsn/t-1	WS-Topics standard
wsa	http://www.w3.org/2005/08/addressing	WS-Addressing standard
nhin	http://www.hhs.gov/healthit/nhin	

This specification establishes the use of the namespace identifier “<http://www.hhs.gov/healthit/nhin>” as the namespace identifier for the XML schema to support this Publish/Subscribe specification.

3.1.1 Use of SAML Assertions in Publish/Subscribe Messages

Each transaction identified in this specification must contain assertions about the identity and role of the user or system initiating the request. In some cases, a “subscribe” message may be issued on behalf of a particular end user; in those cases that user’s name, organization, and role should be included in the SAML assertions as defined in the NHIN Authorization Framework. In other cases, a “subscribe”, “unsubscribe”, or “notify” message may be sent on behalf of the NHIO “system” or infrastructure itself. In those cases, the message should contain a name and organization of a systems administrator for the NHIO, a user role, and a purpose for use.

3.1.2 Subscribe

The Subscribe message is used as defined by WS-BaseNotification. It must contain:

- A <ConsumerReference> element, which is a wsa:EndpointReference giving the WS-Address of the endpoint to be notified as a result of this subscription,

The Subscribe message for HIEM constrains WS-BaseNotification by requiring the presence of the following otherwise optional sections of a Subscribe message:

- A <wsnt:Filter/wsnt:TopicExpression> element, in which the subscriber identifies a Topic and/or Subtopic to which the subscription applies, and
- A <wsnt:Filter/wsnt:TopicExpression/@Dialect> element, required when using the <wsnt:Filter/wsnt:TopicExpression> element. This element defines the dialect of the TopicExpression. The default dialect for HIEM transactions is the “Concrete” dialect. However, specific topic profiles may require other dialects. Profiles that require alternative dialects will define them.

The SubscribeResponse must contain a <SubscriptionReference> element, which is a wsa:EndpointReference. This Endpoint Reference must contain a unique reference to the subscription created. This can be done by creating a unique URI to represent the subscription, or by using the <wsa:ReferenceParameters> element. If the wsa:ReferenceParameters is used, the content of the reference parameter may (but is not required to) use the nhin:SubscriptionId element.

The <SubscriptionReference> Endpoint Reference is the address to which future unsubscribe requests are addressed.

The SOAP Action for the subscribe request is:

<http://docs.oasis-open.org/wsn/bw-2/NotificationProducer/SubscribeRequest>



3.1.3 Unsubscribe

The Unsubscribe message is used as defined by WS-BaseNotification. There is no content on the Unsubscribe request – only an empty “Unsubscribe” element is required. The Unsubscribe request is addressed to the Endpoint Reference that was returned on the SubscribeResponse. The rules for converting an Endpoint Reference into a SOAP address are described in Section 2.3 of the WS-Addressing specification (<http://www.w3.org/TR/ws-addr-soap/#bindrefp>). These rules require that any Reference Parameters included in on the Endpoint Reference be encoded as a SOAP header element.

This transaction should carry in the SOAP header a user identification of a system administrative user defined by the requesting NHIO, the name of the NHIO as the organization, and a user role of “IT Professional”.

The SOAP Action for the unsubscribe request is:

<http://docs.oasis-open.org/wsn/bw-2/SubscriptionManager/UnsubscribeRequest>

3.1.4 Notify

The Notify message used in the NHIN is a “raw” Notification (containing application-specific content) as defined by WS-BaseNotification. HIEM further constrains WS-BaseNotification by requiring the presence of the following otherwise optional sections of a Notify message:

- A <wsnt:SubscriptionReference> element, containing the same content that was in the Subscription Reference of the Subscribe Response for the subscription that this Notify is in fulfillment of.
- A <wsnt:Topic> element, a TopicExpression containing exactly one Topic, which must be the Topic that is associated with the Notify message. This element describes the Topic that matches a previously received Subscribe message.
- A <wsnt:Topic/@Dialect> element, the dialect used in the TopicExpression. This must be the same dialect used in the Subscribe message.
- A <wsnt:Message> element, containing the application-specific content as defined by the applicable HIEM Profile that references this specification.

The Notification message must be addressed to the WS-Address given in the ConsumerReference element of the subscription request. The rules for converting an Endpoint Reference into a SOAP address are described in Section 2.3 of the WS-Addressing specification (<http://www.w3.org/Submission/ws-addressing/>). These rules require that any Reference Parameters included in on the Endpoint Reference be encoded as a SOAP header element.

The SOAP Action for the Notify message is:

<http://docs.oasis-open.org/wsn/bw-2/NotificationConsumer/Notify>

3.2 Content Semantics

Content semantics contained in the Subscribe and Notify messages will be defined in the applicable HIEM Profile for each transaction type.

4 Error Handling

Faults should be sent as defined by WS-BaseNotification. HIEM Profiles referencing this “Base” specification may describe specific cases where certain faults should be used.

5 Auditing

The NHIN HIEM Web Service Interface Specification requires the use of logging, as per applicable law, regulations, and best practices, using the IHE ATNA Profile Record Audit Event transaction. Rather than reproduce the IHE material here, the reader is strongly encouraged to review the IHE framework in final



text status at: http://www.ihe.net/Technical_Framework/upload/IHE_ITI_TF_6-0_Vol2a_FT_2009-08-10-2.pdf section "3.20 Record Audit Event" and especially table 3.20.6-1.

A NHIO should create an "Export" audit event when sending a Notify message to another NHIO.

A NHIO should create an "Import" audit event when receiving a Notify message to another NHIO.

Additionally, NHIOs are should create audit events when requesting, terminating, or accepting subscriptions.

The reader is also referred to the NIST's document (SP800-92) focusing on logging requirements, including those implied by HIPAA. Discussed are policy issues (which should be established for each organization), procedures, goals, requirements, and a list of resources. It may be found at: <http://csrc.nist.gov/publications/nistpubs/800-92/SP800-92.pdf>

The IHE has provided an implementer's FAQ related to logging with a focus on specific uses of ATNA logging and design tradeoffs. It may be found at: http://wiki.ihe.net/index.php?title=ATNA_Profile_FAQ



Appendix A: Sample Messages

These sample messages show subscribe, unsubscribe, and notify messages with empty content. Comments within the XML show where content should be placed.

The SOAP addressing is shown in the Unsubscribe and Notify messages to demonstrate how the Endpoint References from other messages are used to address these messages.

Sample Subscribe

```
<wsnt:Subscribe xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
  xmlns:wsa="http://www.w3.org/2005/08/addressing"
  xmlns:nhin="http://www.hhs.gov/healthit/nhin">

  <wsnt:ConsumerReference>
    <!-- this is the endpoint to notify -->
    <wsa:Address>https://csnhintiapps03.cgifederal.com:6151/Subscribe
    </wsa:Address>
    <wsa:ReferenceParameters>
      <nhin:UserAddress>lee.morgan@carespark.com</nhin:UserAddress>
    </wsa:ReferenceParameters>
  </wsnt:ConsumerReference>

  <wsnt:Filter>
    <wsnt:TopicExpression Dialect="http://docs.oasis-open.org/wsn/t-1/TopicExpression/Concrete">
      nhin:GIPSE/Biosurveillance/InfluenzaLikeIllness
    </wsnt:TopicExpression>
  </wsnt:Filter>

</wsnt:Subscribe>
```

Here is an example of a topic tree expression to support the above subscribe message:

```
<wstop:TopicNamespace targetNamespace="http://www.hhs.gov/healthit/nhin"
  xmlns:wstop="http://docs.oasis-open.org/wsn/t-1"
  xmlns:nhin="http://www.hhs.gov/healthit/nhin"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

  <wstop:Topic name="GIPSE">
    <wstop:Topic name="Biosurveillance">
      <wstop:Topic name="InfluenzaLikeIllness" messageTypes="nhin:gipse"/>
    </wstop:Topic>
  </wstop:Topic>

</wstop:TopicNamespace>
```

SubscribeResponse for Accepted Subscription

```
<wsnt:SubscribeResponse xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
  xmlns:wsa="http://www.w3.org/2005/08/addressing"
  xmlns:nhin="http://www.hhs.gov/healthit/nhin">

  <wsnt:SubscriptionReference>
    <wsa:Address>
      http://www.nchica.org/SubscriptionManager
    </wsa:Address>
    <wsa:ReferenceParameters>
      <nhin:SubscriptionId>382dc7-8e84-9fdc-8443-48fd83bca938</nhin:SubscriptionId>
    </wsa:ReferenceParameters>
  </wsnt:SubscriptionReference>

</wsnt:SubscribeResponse>
```



Response for Unsupported Subscription

If an NHIO does not support a given topic or sub-topic, it would reply to a subscribe message with the following fault response:

```
<env:Envelope xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
  xmlns:wsrf-bf="http://docs.oasis-open.org/wsrf/bf-2"
  xmlns:env="http://www.w3.org/2003/05/soap-envelope"
  xmlns:xml="http://www.w3.org/XML/1998/namespace">
  <env:Body>
    <env:Fault>
      <env:Code>
        <env:Value>env:Sender</env:Value>
      </env:Code>
      <env:Reason>
        <env:Text xml:lang="en">Topic not supported</env:Text>
      </env:Reason>
      <env:Detail>
        <wsnt:TopicNotSupportedFault>
          <wsrf-bf:Timestamp> 2005-05-04T20:18:44.970 </wsrf-bf:Timestamp>
          </wsnt:TopicNotSupportedFault>
        </env:Detail>
      </env:Fault>
    </env:Body>
  </env:Envelope>
```

Sample Unsubscribe

This example shows the SOAP addressing headers. The Endpoint Reference contained on the SubscriptionReference element of the SubscribeResponse is now the address to which the Unsubscribe is addressed. The <wsa:ReferenceParameter> becomes a header block in the SOAP header, as specified by WS-Addressing. The unsubscribe response has no content.

```
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
  xmlns:wsa="http://www.w3.org/2005/08/addressing"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
  xmlns:nhin="http://www.hhs.gov/healthit/nhin">
  <s:Header>
    <wsa:Action>http://docs.oasis-open.org/wsn/bw-2/SubscriptionManager/UnsubscribeRequest
    </wsa:Action>
    <wsa:MessageID>382dc9-8e86-9fde-8445-48fd83bca93a</wsa:MessageID>
    <wsa:To>http://www.nchica.org/SubscriptionManager</wsa:To>
    <nhin:SubscriptionId>382dc9-8e84-9fdc-8443-48fd83bca938</nhin:SubscriptionId>
  </s:Header>
  <s:Body>
    <wsnt:Unsubscribe/>
  </s:Body>
</s:Envelope>
```

Sample Notify

```
<s:Envelope xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:a="http://www.w3.org/2005/08/addressing"
  xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
  xmlns:nhin="http://www.hhs.gov/healthit/nhin">
  <s:Header>
    <a:Action s:mustUnderstand="1">
      http://docs.oasis-open.org/wsn/bw-2/NotificationConsumer/Notify</a:Action>
    <a:MessageID>urn:uuid:a02ca8cd-86fa-4afc-a27c-616c183b2055</a:MessageID>
    <a:To s:mustUnderstand="1"> https://csnhintapps03.cgifederal.com:6151/Subscribe</a:To>
    <nhin:UserAddress> lee.morgan@carespark.com </nhin:UserAddress>
  </s:Header>
```



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```
<s:Body>
  <wsnt:Notify>

    <wsnt:NotificationMessage>
      <wsnt:SubscriptionReference>
        <a:Address> http://www.nchica.org/SubscriptionManager</a:Address>
        <a:ReferenceParameters>
          <nhin:SubscriptionId>382dc7-8e84-9fdc-8443-48fd83bca938
          </nhin:SubscriptionId>
        </a:ReferenceParameters>
      </wsnt:SubscriptionReference>

      <wsnt:Topic Dialect="http://docs.oasis-open.org/wsn/t-1/TopicExpression/Concrete">
        nhin:GIPSE/Biosurveillance/InfluenzaLikeIllness
      </wsnt:Topic>

      <wsnt:Message>
        <!-- message content goes here -->
      </wsnt:Message>
    </wsnt:NotificationMessage>

  </wsnt:Notify>
</s:Body>
</s:Envelope>
```